Faculty of Cognitive Science and Human Development

USING TECHNOLOGY ACCEPTANCE MODEL TO TEST USER ACCEPTANCE TOWARDS COGNITIVE SCIENCE PROGRAM WEBSITE

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by

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Thank you.

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ABSTRACT

Using Technology Acceptance Model To Test User Acceptance Towards Cognitive Science Program Website

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Generally, this study was aim to evaluate the factors that might influence the users' perception in using the Cognitive Science Program website by extending the Technology Acceptance Model (TAM). TAM suggests perceived ease-of-use and perceived usefulness can used to explain and forecast individual acceptance of Information Technology (IT). This study was extended the TAM in testing the design of website as one of the external variable that might influence user perception towards websites. There are one hundred randomly selected students from University Malaysia Sarawak (UNIMAS), Sarawak. Respondents are required to visit Cognitive Science Program website and answer all the questions available in the questionnaire. Based on the data available, the result indicate a moderate fit between website design and two beliefs of TAM (PEOU and PU) and there is a significant relationship between four factors that might influence website design, which are key information, graphic design, download time and linking. However, result shows that there is no significant relationship between demographic factors with factors that might influence users' perception towards website. This study have some suggestion for future research, such as consider other factors, such as social or culture aspect and investigate whether language that familiar with user will increase their attitude towards using.

ABSTRAK

Guna Technology Acceptance Model dalam Menguji Penerimaan Pengguna Terhadap Laman Web Program Sains Kognitif

Koo Voon Ting

Pada umumnya, kajian ini bertujuan untuk melakukan penyiasatan awal terhadap faktor yang mungkin mempengaruhi tanggapan pengguna dalam mengguna laman web Program Sains Kognitif dengan mengaitkannya dengan Technology Acceptance Model (TAM). TAM mencadangkan bahawa kesenangan untuk mengguna dan kegunaannya dapat menerangkan dan meramalkan penerimaan individu terhadap Teknologi Maklumat (TM). Kajian ini mengaitkan TAM dalam menguji sama ada rekabentuk laman web akan mempengaruhi tanggapan pengguna ke arah laman web Program Sains Kognitif. Seratus pelajar Universiti Malaysia Sarawak (UNIMAS) telah dipilih secara rawak dan mereka dikehendaki mengekses laman web Program Sains Kognitif dan menjawab soalan berdasarkan soal selidik. Hasil kajian menunjukkan terdapat hubungan yang sederhana antara rekabentuk laman web dengan dua kepercayaan dalam TAM (kesenangan untuk mengguna dan kegunaan) dan hasil kajian juga menunjukkan terdapat hubungan antara empat faktor yang mempengaruhi rekabentuk laman web iaitu, maklumat, rekabentuk, masa untuk mengisi data (download) dan sambungan. Akan tetapi, hasil kajian menunjuk tidak terdapat sebarang hubungan antara faktor demografi dengan faktor yang mempengaruhi tanggapan pengguna terhadap laman web Program Sains Kognitif. Kajian ini mempunyai beberapa saranan kepada para penyelidik masa hadapan, seperti menyiasat sama ada bahasa yang biasa digunakan oleh pengguna akan meningkatkan sikap mereka terhadap penggunaan dan menentukan sama ada faktor lain seperti aspek sosial dan budaya akan menpengaruhi persepsi pengguna terhadap laman web.

CHAPTER 1
INTRODUCTION

1.0 Background

Internet was started in May 1993 with only 50 websites online (Ford & Dixon, 1996). Companies during that time used website to promote their products and service to web user and to be one step earlier than their competitors by attracting worldwide customers. Managers did not consider much on how to design a website that providing the best way in serving their customers. They even not consider the human factor and interface design for the website. As a result, website is just a font-end look well but usability is less take in consideration (Kahn, 1997).

In year 1996, research on Human Computer Interaction (HCI) makes people realize there is something wrong with the Website and need to solve quickly. In May 1996, a symposium with the title " The Missing Link: Hypermedia Usability Research and The Web", held at The Open University's Knowledge Media Institute (Shum, 1997).

Then researchers started to actively involving themselves in doing their research related with the interaction between human and computer. They start to question, is there any relation between job performance and website (Shnudermans, 1997). Besides, Tauscher and Greenberg (1997), Erskine, Carter-Tod and Burton (1997) provides a helpful information related to how to design the web browser and way to redesign the old style website to become a usability website (Shum, 1997).

Today, everyday hours and minutes, there is a new website created in the Internet. According to Nielsen (2000), there are about 10 million websites available on Internet in January 2000 and predict by year 2002, website might reach hundred million. Booming progress of websites within short period of time is due to more and more user is using website as one of the important media to promote and publish their knowledge, new products or services, latest news to web user.

This cause information overload since there are too much of information that user can get. For example, when a user want to find article related to designing a usability website on the search engine, user can get thousands of information, which some are related and some are not related.

To standardize the design of the website, researcher starts to carry out research to determine the factor that can attract user attention because survey found out that the quantity of inexperience user increase, there are 106 million adults access Internet at least once during 1998 and is 48 percent increases from year 1997 (Keeling & Macaulay, 1998). Nielsen in Designing Web Usability stated usability is the most important aspect in

designing website because the structure of the website should base according to the needs of user, such as giving information of what they want in order to attract their attention and motivation in using the websites (Nielsen, 2000).

Hubona, G.S. and Kennick, E (1996) believed that the determination of an effective website must fit between technology and task and between individual characteristics and the technology. As a result, this study aimed to extend the Davis' Technology Acceptance Model (TAM) to broaden the application of this model to explain the usability of Cognitive Science Program website by looking at the interface design, ease-of-use and usefulness.

1.1 Definition

1.1.1 Technology Acceptance Model (TAM)

Technology Acceptance Model (TAM) was created to explain and predict the individual's acceptance of Information Technology (Davis, 1989). The original version of the TAM used belief–attitude–intention–behaviour relationship to predict users acceptance of information technology. The beliefs stated here are perceived usefulness and perceived ease-of-use (Heijden, 2000; Lederer et. al., 1998). Based on these beliefs, it is to predict that a person's intention towards a particular system is based on the attitude towards the system.

1.1.2 Website

Richard (1995) stated that website is a collection of protocol used to access and retrieve the information available on the Internet (Vora & Helander, 1997). While Bickford (1997) defined website as a Turkish bazaar that contains lots of information filled with millions of people hawking around and trinkets the data to get user attention. Consequently, he recommended an attractive website should fulfil user requirement by providing what user is looking for and ensure that the whole experience is enjoyable enough to let them come back again.

More to the point of website, website is not just only a place to access and retrieve information but also allow links to others document (files) stored in servers around the world. The documents available might not be just a plain text but can be in the form of multiple media, such as graphics, sound, video and more recently virtual reality. Therefore, publishing products or services online are more attractive than advertisement on the newspaper because there is animation that can use to attract user attention.

1.2 Problem Statement

According to Nielsen, a usability expert, a usability website should spend about 80 percent or half of the space by filling what user interest when they are visiting the website. Unfortunately, most of the sites using the available blank space for navigation and some of the websites even waste by placing blank space as part of the website.

Research by Nielsen (1998) found out reading from computer screen is about 25 percent slower than reading from paper. Thus, people dislike reading a lot of text and scrolling around during their reading in front of the computer screen. People tent to face

eyes cramp, dry and pain during their reading. This kind of experience cause impatient users tends not to read full text but scan.

Another study carry out by Nielsen and Morkes (1997), 79 percent of respondents always scanned any new page they came across and only 16 percent read word by word. During the scanning process, people tend to look through the heading, large type, bold text, highlighted text, bulleted lists, graphics, caption, topics sentences and table of contents (Nielsen and Morkes, 1997). As a result, text should be 50 percent less as in original text. If developer needs user to pay more attention on certain important information, the wording should highlighted, bold or larger size than other, so that it makes different with other words.

The Graphic, Visualization and Usability (GVU) Centre at the Georgia Institute of Technology conducted research for every six month to determine the problem that user mostly face when they dealing with the website. They discovered some problem, for example slow speed of downloading or viewing web pages.

Furthermore, there are users unable to find a page that they knew existed or find a page that they had seen. User also complain information that available online do not well organize and gather. Besides, some of the respondents also grumble with the website that difficult to search for specific information, information that confuse user, time delay for images that is not important, advertisement, unreliability site, website that require user to log in (just for member only) and incomplete category searches. According to a recent survey on websites usage, the primary usage of websites are education, shopping, entertainment, work, communication, personal information and others activities.

User feel that waiting for download and search result is boring and a waste of time because the result of the search may not be the one that they needed. Users also feel irritated when they have to download a big graphics file because it takes a long time to view it.

If a website do not have a navigation support, this makes user feel very hard to find things. Linking is the most important part of hypertext because it helps user to connect one page and another pages. According to Nielsen (1998), if a website that provides navigation, is easy for user to click but is not easy to know what to click on. Since, there are not description telling what is going to present next and what result is going to achieve. When a website that contain too much of navigation, this may cause get lost and cannot find the page that they are looking for.

1.3 Research Objectives

1.3.1 General objective

Generally, this study aims to evaluate the factor that might influence users perception in using the websites. This is due to research conducted by Nielsen and GVU Centre, the websites available online today contains too much of problems that should be take in consideration. This study was conducted in University Malaysia Sarawak (UNIMAS), Sarawak.

1.3.2 Specific objectives

- Determine to what extend the Cognitive Science website can assists students understanding of the website.
- Investigate the relationship of two beliefs of TAM, which is perceived ease-of-use and perceived usefulness with interface design of Cognitive Science Program website.
- Investigate the different between demographic factors and the factors that might influence users perception of the Cognitive Science Program website.

CHAPTER 2
LITERATURE REVIEW

2.0 Introduction

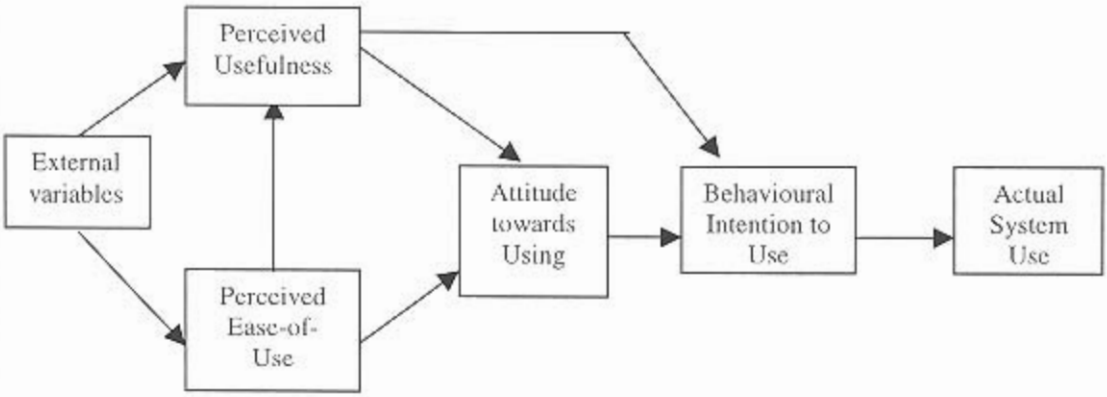
This chapter discusses previous research related to Technology Acceptance Model and how to design a user friendly website.

2.1 Theoretical Background

2.1.1 Technology Acceptance Model (TAM)

Technology Acceptance Model applied Fishbein and Ajzen's Theory of Reasoned Action (TRA) to show that the beliefs of user can influence user attitudes towards using, which leads to intentions, and therefore generates behaviors. Davis (1989) thus considers TAM's is creating to explain and predict individual acceptance of Information Technology (IT).

Figure 1: Original Technology Acceptance Model (Davis, F.D, Bagozzi, R.P, Warshaw, P.R, 1989)



There are two beliefs in Technology Acceptance Model, as shows in the figure 1. The two beliefs are:

(a) Perceived ease-of-use (PEOU)

PEOU is defined as "*the degree to which a person believes that using a particular system would be free of effort*" (Davis, F.D, Bagozzi, R.P, Warshaw, P.R, 1989; Davis, F.D, 1996; Lederer, A.L et al, 1998; Malhotra, Y & Galletta, D.F, 1999; Heijden, H, 2000). This statement shows that the amount of effort user need to spend in navigate the system is determine by the ease of use of the system. Ease-of-use is a concept that takes in consideration of user satisfaction stream of Information System (IS) research (e.g. Doll & Torkzadeh, 1988) and e-commerce (e.g. Oinas-Kukkonen, 2000).

According to Davis (1989), he believed that all things are equal, a system that is easier to use will increase intention to use compare with a system that is less ease-of-use. Besides, a system that requires less effort is perceived to be more favorable than a system, which requires more effort (Davis, 1989).

(b) Perceived usefulness (PU)

PU is defined as "*the degree to which a person believes that a particular system would enhance his or her job performance*" (Davis, F.D, Bagozzi, R.P, Warshaw, P.R, 1989; Davis, F.D, 1996; Lederer, A.L et al, 1998; Malhotra, Y & Galletta, D.F, 1999; Heijden, H, 2000). This statement shows that usefulness of a system is positively associated with the attitude towards using the system. There are also some evidence shows usefulness of a system can leads to more use.

2.2 Previous Research on Technology Acceptance Model

According to Davis and Venkatesh (1995), TAM is not a function in grouping multiple items together in measuring a single construct. The study found out that when item is intermixing, it would cause fatal effects on the reliability, validity and health-related behaviors because subjects feel that intermixed format is very confusing compared to familiar behavior. Based on this point, the research suggested that TAM is a strong model in testing the theoretical framework and is reliable in testing the acceptance of information technologies. This is a very important point for future research that want to extend this model in testing the individual acceptance of information system.

One study (Leaderer, Maupin and Zhuang, 1998) had conducted to validate the application of TAM to the usage of website. The research predicted website usage could helps in testing user application and classification of the system that might be one of the factors contribute to PEOU and PU. The research data found out that website is reliant on the usefulness of the content and ease of use of the website. Thus, this research recommended web manager in aware the characteristic of ease-of-use and usefulness and use this information as a guideline in developing website. Besides, web manager should also paying more attention in using consistent and understandable term with relevant and reliable information because users today relied heavily on the website to get up-to-date

information and news. However, pleasing design does not appear to be so important in promoting frequent usage of website.

Eikebrokk and Sørebo (1998) found out when there are several alternative technologies exist, technology acceptance will be affected because user will tend to compare alternatives technology with the available technology. The correlation between PEOU and PU was greater than between the usefulness and relative use of modified model. When respondent had chosen an object or a system as their alternative, it would increase the system use compare with other relevant technologies that available during the research. This shows that TAM model is useful in testing respondents acceptance of system when they have several alternative systems that can used in accomplish their task. This study helps system designer in developing a better design system that can achieve users demand.

Fenech (1998) also using TAM to conduct a study that test the additional behavioral construct of computer self-efficiency for website application. The result from the data available was successful correlated with the two beliefs of TAM when computer self-efficiency was including during the analysis.

According to Heijden (2000), relationship between PU, perceive entertainment value and website revisit were significant but relationship between PEOU, perceive attractiveness and website usage were not significant. Results shows that entertainment value is highly correlated with website usage and website usefulness. However, attractiveness of website does not directly influence website usage. The result shows that when the website is useful and entertaining then it will attract respondents in using the website. On the other hand, games and competition cannot attract respondents' attention in the sense of business because respondents prefer website with clear entertainment value. Based on the result, it show that respondents tend to spend more time in navigate around websites that is entertaining. So, this research suggest adding entertainment feature to traditional information system (system that do not have entertainment value) would be more attractive to users compare with adding usefulness feature. However, this study cannot find a significant relationship between ease-of-use and website usage, and relationship between respondent preferred layout with colours that can lead to website usage.

Another research conducted by Heijden (2000) was using a theoretical framework to determine the factor influencing a visitor's return to a website by extending TAM. This research consider the competitive environment and visitors evaluation of the usefulness and enjoyment of the website compare with their rivals website. This research modified the original TAM model by replacing the dependent variable actual system use by actual website revisit, and usage intention replace by website revisit intention and perceive relative usefulness replaces usefulness. Moreover, this research excluded attitude because it predicts that there is no meaningful relationships between PEOU, PU and intention. Besides, the direct relationship between PEOU and intention is also removed. This research proposed that a useful and enjoyable website is relative to its competitive advantage.

Jiang, J. J., Hsu, M. K., Klein, G. and Lin, B. (2000) in their study of E-Commerce indicate that the use of the Internet is positively related to perceived near-term usefulness, perceived long-term usefulness, prior experience, and facilitating conditions. Moreover, this study also found out that experience is the one of the major implication and factor that can influence respondent in using the Internet. Result shows that the longer the time

respondents' expose to Internet, the more likely they will continue to surf. Result also support the statement proposes by Davis (1989) where there is a significant relationship between ease-of-use and usefulness condition in Internet. In addition, respondents are prefer website that provides linking to other related pages but the information should constantly updated.

Kim and Moon (2001) stated that PEOU and PU are important feature that influence user perceptions of website. While perceived playfulness seems influence more on user's attitude toward using the website. Based on the result, PEOU is significantly related with perceived playfulness and PU. Thus, this research suggested that one of the factors that should take into consideration when designing a website is perceived playfulness and future designer should provides a more concentrate, and enjoyable website because perceived playfulness can influence user attitude towards using. Besides, perceived playfulness also have a positive effect on behavioral intentions to use. The research also divided the sample into two groups, which are entertainment-purpose group and work-purpose group. The purpose of this research is to compare the effects of usefulness and playfulness under different task contexts. The entertainment-purpose group is an intrinsically motivated group because they used surf for leisure or playing purposes. The work-purpose group consists of people who primarily using the website for work purposes. Result show that entertainment-purpose group is more significant on behavioral intentions than perceived usefulness. But, work-purpose group, is more significant in perceived usefulness than perceived playfulness. But, result shows that playfulness can motivate not just only to entertainment-purpose users but also work-purpose. Based on this result, it shows a clear implication on how perceived playfulness influence website design.

Wiberg (2001) in his paper on usability evaluation for entertainment is fit to test in pairs, especially when respondents are kids. However, adults pairs makes subject like to compete and "showing-off" with each other. Study found out that structured tasks were a poor choice in evaluation technique because respondent feel stress and scared that they cannot accomplish their task in the require time compare to instructive activities that allows respondents more free to surf. In the tests, structured task fail to support all the testing websites. This situation also occurred when mixed approach is used, which is the combination of structured and unstructured tasks. Respondents feel confused when suddenly a pop-out message recommends them to perform free surf. Result also shows that navigation was not something subjects found entertaining. When comparing children and adults, children are more natural and explorative because they like playing around compare to adults. For adults, they are better in thinking abstractly and express more frequently compare to children who got completely quiet during the test. Besides, study also found out that oral answer is more prefer by respondents compare with questionnaire.

Dishaw and Strong (1997) in their paper of Extending Technology Acceptance Model had developed and evaluate an integrated TAM/TTF model. The Task-Technology Fit Model (TTF) suggested that software will be in used if, and only if, the functions available can support user's activities. This paper suggested that there is a significant relationship between TTF and PU but only a mediation effect of PEOU. Moreover, TTF also determine by the utilization of TAM model, where the utilization variance is higher when TTF and TAM model is combined than examine it separately. This paper recommended usefulness, ease-of-use and general attitude towards using the tools have more effect for users' perception. While other aspects are affected by the functionality of

the software in matching for specific needs of task. Therefore, this paper suggested the actual utilization is depends not just only to PEOU and PU, but also depends on how well the tool function and matches the needs of task.

Studies conducted by Hubona and Whisenand (no date) verify that TAM does not explain significant the proportion of the variance in usage frequency and usage volume behaviors. The study was proof their statement by re-examined the direct and indirect influences of the external variable upon attitude, usage frequency and usage volume. Based on the result, there were no significant effects of any external variables directly upon attitude but there were significant effects of system familiarity on usage frequency and usage volume. This paper explained much on the variances in usage frequency and usage volume than the original empirical model because this paper indicates that PEOU and PU and attitudinal constructs do not fully influence all external variables upon usage behavior but end-user behavior may be better predicted by consider the direct influence of selected external variables.

Galletta and Malhotra (1999) suggest that social influence play an important role in determining the acceptance and user behavior during their adaptation of new information technologies. If social influences generate a feeling of compliance, user will have a negative influence on the users' attitude towards using of the new information system. On the other hand, social influences that generate internalization and recognition, user will have a positive influence on the attitude toward the acceptance and the use of the new information system. So, internalization plays an important role of persuades user's behavior during the adaptation in shaping new acceptance and usage behavior compare to PU of the system. This means that, PEOU and PU are not stable because internalization may have a stronger influence on attitude toward using the new information system. This research believes that social influences and psychological attachment of user in accepting new information system have a better understanding compare to TAM. The study also shows that there is no significant relationship between social influences and behavior intentions but there is a direct effect between social influence and attitude. As a result, innovation acceptance and initiatives is the prominence key that needs to consider during the development of information system.

2.3 Previous Research on Website

According to Dalal, Quable and Wyatt (2000), one of the major causes of poor cognitive design website is lack of guidelines to design and develop hypermedia applications. Most of the design available online today are based on the designer perception and common sense. There are two factors that might influence web user, which are coherence, a positive influence, and cognitive overhead, control user's ability in forming mental model. Cognitive overhead is related to orientation, navigation, and interface design because human have a limitation in information processing (Dalal, Quable and Wyatt, 2000). This is the reason why too much of navigation can cause user feel bored to continue or go deeper for more detail information. Overall, this study shows that website that design based on human limitation can produces significantly better and faster understanding compare with a non-cognitively designed home pages.

Nielsen (2001) in his study on the 3C's Critical Web Use: Collect, Compare, Choose found out 71 percent of web user searching multiple piece of information with a

specific goal but not a specific answer and 25 percent of web user searching for something specific. While there are 2 percent of web user exploring the web without a specific goal and there are also 2 percent of web user revisit the same website to update their information.

Serco Usability Services (no date) proposed that the development of web site should be user-centred, which means every design evaluation should meets user requirements. The design that should consider the writing style, navigation and page design because end users prefer structure text and reasonable design. So, from the research conducted by Nielsen (2001) and Serco Usability Service (no date), it conclude that during the process of designing web designer should consider user-centred design because users prefer website that is effective, efficient and satisfy. Thus, it is important for web designer to maintain the usability of website to increase the number of web user visiting the website.

2.3.1 Site structure and content

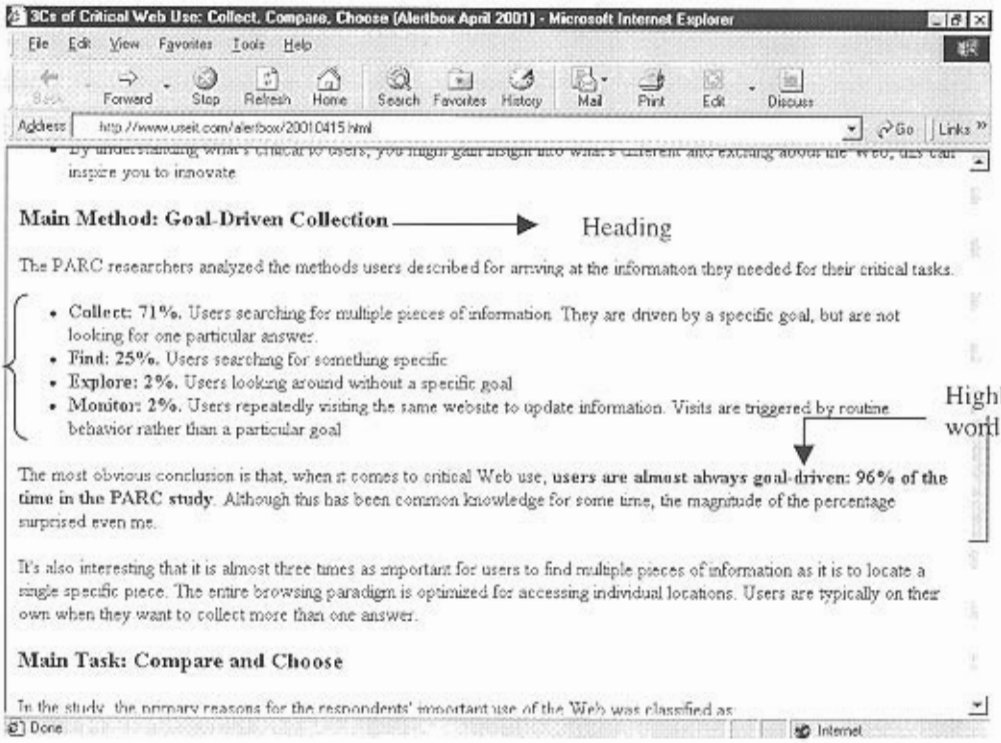
Serco Usability Services (no date) found out that one of the reasons user feel difficult to find the content that they wish is due to most of the website less concern on the need of user.

From a study conducted by Nielsen and Morkes (1997), the structure of information should make sense and meaningful to the user. However, the structure that used cannot be standardized because different user groups have different needs of interfaces. However, no matter how different the user group is, the content and the term used should be familiar to them. User will find difficult when there are many words that is not familiar to user. Not just only that, clarity the right amount of information is also very important.

2.3.2 Writing style

Nielsen and Morkes (1997) in their studies of how users read on the Web found out that web users actually do not read but they scan through the text. During their scanning process, they tend to read the first sentence of each paragraph to predict the usage of information. Besides, user also look for key information, such as bulleted list, highlighted keywords, heading, large type, bold text, graphics, captions, topic sentences, and tables of contents to help minimising their reading on the computer screen (refer figure 2). This is due to another research conducted by Nielsen (1998) found out that reading from computer screen is 50 percent slower than reading from papers. From the information above, it suggested to web designer the first sentence of every paragraph is very important because it represent the whole information that want to present. Moreover, web designer also recommended using key information that mention in the previous paragraph because this can minimize user from reading too much.

Figure 2: Writing Style for Website (Retrieve from http://www.useit.com/alertbox/20010415.html)

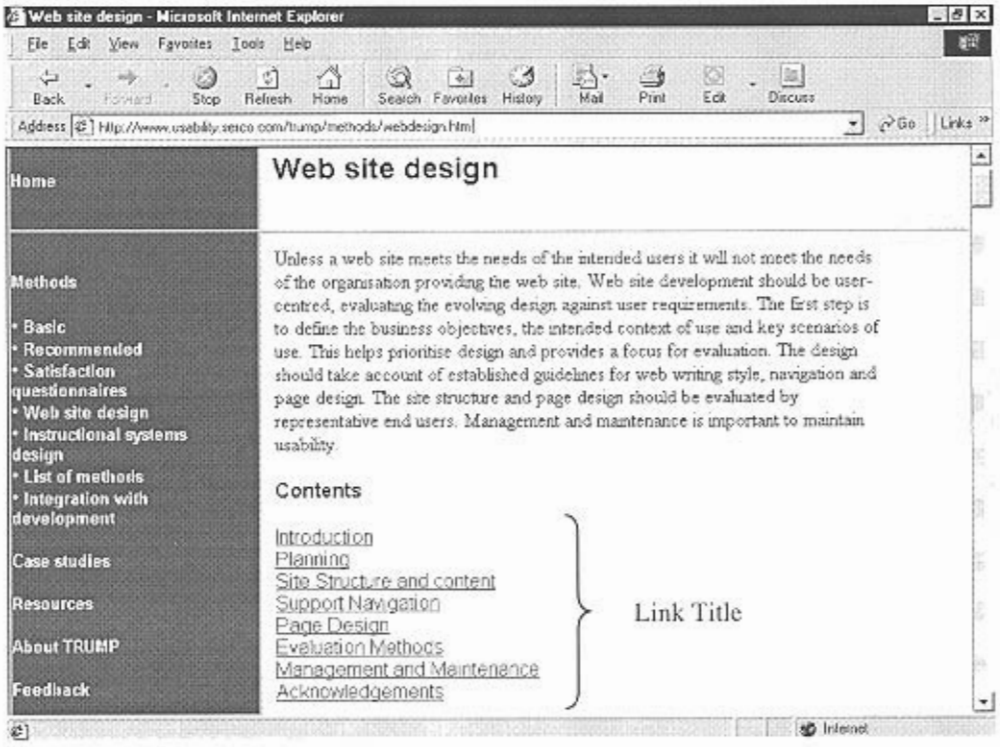


2.3.3 Support navigation

2.3.3.1 Linking

Linking is the most important part of hypertext because it helps user to connect the current pages to other relevant pages. Although linking is very important but from the survey conducted by GVU's Tenth WWW surveying team (1998), 9 percent of the problem in the web is dealing with broken link (link that cannot link). Users are very relies on link because it helps user in assessing more detail information or term that is unclear to them. When users are looking for information, they are not just only looking for one but many solution that can used to support the information that they wish. Hence, it is important for web designer to provide linking if they want users to know more about the information available in the current page.

Figure 3: Links (from
http://www.usability.serco.com/trump/methods/webdesign.htm)



According to Nielsen (2000), links can be divided into three forms, which are structured navigation links, associative links within the content of the page and list of additional references. When homepage buttons link to a set of subordinate pages, this form of link is structured navigation links. This kind of links allow user going to other part of the space with structured information. While associative links are links used by underline words or link used to provide more detail information of the available text. Additional reference link are help link for user who cannot find what they want in the current page, such as "See Also" link.

However, every navigation page should tell the user where they are going when they click on the link button or by given a link title with a short summary of what kind of additional information is available when they link because it helps user reduce link to irrelevant website. According to Nielsen (2000), a link titles should be less than 80 characters, which mean the shorter link title the better. So, designer should use a meaningful titled link to minimize the cognitive load. Moreover, web designer can provide a site map or overview at homepage, this helps user understand directly the scope available (refer figure 3).